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TITLE: TEMPERATURE COMPENSATION FOR MAGNETORHEOLOGICAL FLUID DAMPERS

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TEMPERATURE COMPENSATION FOR MAGNETORHEOLOGICAL FLUID DAMPERS

BACKGROUND OF THE INVENTION

1. FIELD OF THE INVENTION

The present invention generally relates to an operation of a magnetorheological fluid (MR) damper. The present invention specifically relates to an application of a temperature compensation to an operating current of a MR damper.

2. DESCRIPTION OF THE RELATED ART

FIG. 1 illustrates a MR damper 10 as known in the art. MR damper 10 includes a cylindrical tube 11 and a cylindrical sleeve 12 affixed to an outer surface of an upper end of cylindrical tube 11 whereby a cavity is formed. The cavity contains a magnetorheological (MR) fluid consisting of small soft-magnetic particles dispersed throughout the cavity. A cylindrical valve 13 having an annular fluid passageway 14 and a coil 15 is slidably positioned within the cavity. Any linear displacement of valve 13 within the cavity involves some degree of flow of the MR fluid through fluid passageway 14. A rod 16 extends through sleeve 12 and is adjoined to valve 13 whereby valve 13 is linearly displaced within the cavity whenever an operating force in the form of a compression force CF or an extension force EF being applied to rod 16 exceeds a damping force of the MR fluid within the cavity.

The damping force of the MR fluid is a combination of laminar forces related to a fluid viscosity of the MR fluid and the dimensions of fluid passageway 14, and shear forces due to the MR effect. Thus, to generate the damping force at a desired force level, a controller 20 supplies an operating current I_{OS} having a corresponding ampere level to a coil 16 via a conductor 21 whereby a magnetic field of a corresponding strength is generated. However, the fluid viscosity of the MR fluid varies strongly with an operating temperature of MR damper 10 based upon an ambient temperature of MR damper 10 and any internal heat generated during an operation of MR damper 10. Consequently, under some operating temperatures, the actual force level of the damping force of the MR fluid can significantly vary from the desired force level of the damping force.

There is therefore a need for a temperature compensation method for overcoming the aforementioned shortcomings described herein. The present invention addresses this need.

SUMMARY OF THE INVENTION

The present invention provides a controller for implementing a method for controlling a damping force of a damper in view of an operating temperature of the damper. Various aspects of the invention are novel, non-obvious, and provide various advantages. While the actual nature of the invention covered herein can only be determined with reference to the claims appended hereto, certain features which are characteristic of the preferred embodiment disclosed herein are described briefly as follows.

One form of the present invention is a method for controlling a damping force of a damper. First, a first operating current is determined as a function of a desired force level of the damping force. Second, a temperature compensation as a function of an operating temperature of the damper is determined. Finally, the temperature compensation is applied to the first operating current to generate a second operating current as a function of both the desired force level of the damping force and the operating temperature of the damper.